* NOTICES *

MEANS

[Means for Solving the Problem]In order to realize the above-mentioned purpose, a liquid crystal display and an organic electroluminescence display of this invention have the following composition.
[0010]In a liquid crystal display of this invention, an electrode with larger width is electrically connected to a picture element electrode using an n channel thin film transistor from which width of a source electrode and a drain electrode differs. When charge is severe polar writing by carrying out like this (i.e., when a picture element electrode becomes negative polarity to a source electrode), current becomes large more and charging capacity can be enlarged. Therefore, a high speed drive becomes possible and improvement in luminosity by numerical aperture rise can be realized.
[0011]In this invention, the above-mentioned thin film transistor is arranged to a panel of a field sequential drive (FSC) drive system which performs high-speed writing of 3 times or more of the usual liquid crystal display. By this, driving ability can improve and luminosity can be raised. Because of improvement in image quality, high-speed writing is more needed and black insertion, white insertion of improvement in driving ability by this invention, etc. are effective, when writing in a non image signal.
[0012]In this invention, to a liquid crystal display of an OCB mode, a thin film transistor with asymmetric structure is arranged so that current may become large, when charge is severe polar writing. By enlarging driving ability, also in a liquid crystal panel of an OCB mode with large liquid crystal capacity, a high speed drive can be performed and a numerical aperture can be enlarged by this invention. Since liquid crystal capacity will become still larger if a cell gap is made small in order to raise speed of response, the validity of this invention becomes large.
[0013]In this invention, it is an OCB mode and the above-mentioned unsymmetrical thin film transistor is arranged to a liquid crystal panel of an FSC drive. By setting it in an OCB mode, rather than an FSC drive of the usual TN mode, still larger driving ability can be needed, and high-speed writing can be attained by improvement in driving ability by this invention, and luminosity can be raised by numerical aperture rise.
[0014]In this invention, capacity of a gate electrode and a drain electrode is enlarged as it separates from an input side of a gating signal. Since the capacity Cgd between a gate and a drain becomes large and a recharge in case a gating signal changes with them from one at OFF becomes large compared with the time of reverse arrangement when structure like this invention is taken, we are anxious about a flicker. A recharge becomes large as it separates from an input side of a gating signal. This is because a waveform of a gating signal becomes blunt as it separates from an input side of a gating signal. it separates from a gating signal input side -- if it is alike, and it follows and Cgd is enlarged, it will be based on capacitive

coupling -- a flicker can be prevented, being able to cancel an effect of a provincial accent of a gating waveform and raising driving ability, since it runs and voltage becomes large.

[0015]This invention constitutes a drain electrode from two or more electrodes. Raising driving ability by constituting from two or more electrodes, a lap with a gate electrode can be suppressed small and increase of Cgd can be controlled.

[0016]In this invention, width of a drain electrode electrically connected to a picture element electrode is made into 2.5 times from 1.2 times of width of a source electrode electrically connected to a source signal line. If a ratio of the above source electrodes and a drain electrode is used in the case of bending structure and structure where a drain electrode comprises two or more electrodes, structure where charging capacity per unit area becomes large is realizable. By this, a numerical aperture cannot be dropped, but charging capacity can be enlarged, and high-speed writing is attained.

[0017]In an organic electroluminescence display of this invention, a thin film transistor from which width of a source electrode and a drain electrode differs is electrically connected to an organic EL device, If a drain electrode and a source electrode set to W1 and W2 each width of a field which has faced mutually, It is W1>W2, and in a p channel type case, it has electrically connected [when a thin film transistor is an n channel type,] with an organic EL device so that a drain electrode may become negative polarity to a source electrode, and a drain electrode may become straight polarity to a source electrode. By this, a current amount which flows into an organic EL device becomes large, and luminosity improves.

[0018]In this invention, at least one side of a source electrode and a drain electrode is made into bending structure. By this, effective channel width per unit area can be made to increase, and a current amount per unit area can be enlarged. That is, driving ability can be enlarged.

[0019]Semiconductor membrane is used as polycrystalline silicon in this invention. Mobility of polycrystalline silicon is large and it can take large current. By using structure like this invention, larger current can be acquired and driving ability can be raised.

[0020]Semiconductor membrane is made into an amorphous silicon in this invention. Although mobility is smaller than polycrystalline silicon, since an amorphous silicon can be deposited directly, it can be built with a routing counter smaller than polycrystalline silicon. Therefore, it can create by low cost more easily than polycrystalline silicon. With the above structures, it can make it possible to take a current amount more, and driving ability can be enlarged.

[0021]

[Embodiment of the Invention]The liquid crystal display of this invention is more concretely explained using a drawing below.

[0022](Embodiment 1) Drawing 1 is a top view showing the 1-pixel electrode configuration on the array substrate in the liquid crystal display of Embodiment 1. Although the current amount of a thin film transistor becomes large in proportion to channel width, in a bent structure, its definition of channel width is complicated. However, it is mostly determined with each effective channel width of the source electrode 20 and the drain electrode 60. In the field to which the semiconductor membrane 30 has lapped with the gate electrode 10, effective channel width is the width of the portion which the source electrode and the drain electrode face mutually. In the structure of drawing 1, the effective channel width of a source electrode becomes without $W_{2\text{-}1}x2+W_{2\text{-}2}$, and the effective channel width of a drain electrode becomes $W_{1\text{-}1}x2+W_{1\text{-}2}$. In the thin film transistor from which the effective channel width of two

electrodes differs, current differs by which electrode becomes straight polarity. The current potential characteristic of a thin film transistor with the structure of drawing 1 is shown in drawing 9. It is the current potential characteristic when the characteristic of A makes the source electrode 20 of drawing 1 straight polarity in the one where effective channel width is shorter. In this case, it is a thin film transistor of N type, and 12V and the drain electrode 60 are grounded to the source electrode 20, and the voltage of the gate electrode 10 is changed to it from 0V to 20V. The characteristic of B is the characteristic when grounding the source electrode 20, setting the drain electrode 60 to 12V conversely and changing the voltage of the gate electrode 10 from 0V to 20V. When many thin film transistors of the structure of drawing 1 were measured, size changed with processing dispersion, but the difference between both the characteristics was about 40 percent from twenty percent. That is, it is, or it makes which into straight polarity, and current changes from twenty percent 40 percent. This depends on parasitic resistance and career distribution changing. This behavior is behavior peculiar to a thin film transistor with the asymmetric structure from which effective channel width differs.

[0023]The conventional structure proposed by JP,3-233431,A is shown in drawing 2. This has structure which the source electrode and the drain electrode replaced in the thin film transistor of the structure of drawing 1. Although the reason which has such a structure is for only making Cgd small, for every writing, the picture element electrode side becomes straight polarity, or charge of a liquid crystal becomes negative polarity in order to perform the drive which rewrites positive and negative amphipathy by turns. The source potential under writing is constant, and when the source signal line side becomes negative polarity with straight polarity, as for the potential of a drain, since it is always smaller than source potential, charge is fully performed, but the picture element electrode side. On the other hand, since the potential difference between a gate and a drain (picture element electrode) becomes small with charge when the picture element electrode side becomes negative polarity, charge becomes severe. That is, the driving ability of the liquid crystal display was decided by charging capacity in case the picture element electrode side becomes the negative characteristic. If the conventional structure of drawing 2 is seen in such a viewpoint, current is the arrangement which becomes small at the time of polar writing with severe charge. In this invention, structure like drawing 1 is used in view of the current potential characteristic with an unsymmetrical thin film transistor with asymmetric structure which we found out. By this, when the picture element electrode side with severe charge becomes negative polarity, current becomes larger, and driving ability becomes large. When the pixel side becomes a positive electrode, charge is far easy compared with the case of being reverse, as mentioned above, and driving ability does not fall by this. Although Cgd increases by using arrangement of drawing 1 from arrangement of drawing 2, Since not only the area of the field with which the drain electrode and the gate electrode only lapped but the area of semiconductor membrane influences, Cgd is based also on the bias of a source electrode, but the increases in Cgd when it becomes the structure of drawing 1 from the structure of drawing 2 are few. In a common liquid crystal display, in the capacity to charge, since Cgd is a rate of about several percent, the increase of influence in current is larger and its driving ability improves as a result rather than the slight increase in Cgd.

[0024]Although the case of n channel type thin film transistor was explained until now, even when using p channel type thin film transistor, as shown in drawing 1, the same effect is acquired by using the structure which lengthened the drain.Because, first, in a p channel type case, when the asymmetry characteristics equivalent to drawing 9 make straight polarity conversely the one among sauce and a

drain where width is longer with n channel type, current becomes large (characteristic of A of drawing 9). This is because the cause which asymmetry characteristics generate is in distribution of a career (electron hole) and parasitic resistance. On the other hand, since the potential difference between a gate and a drain (picture element electrode) becomes small with charge in the operation in which the picture element electrode side changes from straight polarity to negative polarity in using p channel type thin film transistor for pixel charge, charge becomes severe. Therefore, it is preferred to connect to a picture element electrode the one where width is longer among the sauce of a transistor and a drain also in the case of p channel type thin film transistor after all.

[0025]In this example, although it explained to the structure of drawing 1, it can carry out similarly about a thin film transistor with other asymmetric structures. The main point is bringing an electrode with the larger effective channel width among a source electrode and a drain electrode to the pixel side. The structure of a thin film transistor with other asymmetric structures is shown in drawing 5 from drawing 3. Drawing 3 is the same as that of the structure of drawing 1, and it is having structure only repeated periodically. Compared with the structure of drawing 1, one 3 times the current amount of this can be taken. the structure of drawing 4 is close to the structure which divided the structure of drawing 1 -- the effective channel width at this time -- the source electrode side -- $W_{4-1}+W_{4-2}$ -- it comes out, and it is and the drain electrode side becomes, without $W_{3-1}+W_{3-2}$. The structure of drawing 5 is an example by which a drain electrode is constituted from two or more electrodes, the effective channel width by the side of a drain electrode becomes without W_5x2, and the effective channel width by the side of a source electrode becomes, without W_6x2. In addition, although various structures can be taken, the effective channel width of a source electrode and a drain electrode differs, and the effect of this invention can be acquired in a thin film transistor with an unsymmetrical structure by bringing an electrode with larger effective channel width length to the pixel side.

[0026]In order to enlarge charging capacity per unit area, a thing like drawing 1, drawing 3, and drawing 4 for which it bends (crookedness), and is made structure or an electrode is constituted from two or more electrodes like drawing 5 is required. Although various modification can be considered with both structures, the current amount per unit area can be made into the optimal structure to enlarge by increasing an electrode with the larger effective channel width among a source electrode and a drain electrode 2.5 times from 1.2 times of the width of an electrode with smaller effective channel width.

[0027]Since liquid crystal capacity becomes large when a liquid crystal material with an OCB mode is used as a liquid crystal material, the structure of this invention is more effective, and in performing non image signal insertion of black insertion etc., it demonstrates an effect further.

[0028](Embodiment 2) The effect of this invention is improvement in driving ability, and is large to the display and drive method which need high-speed writing especially. [of an effect] There is a liquid crystal display using the field sequential drive (FSC) drive as one of such the liquid crystal displays. The wave-like example of an FSC drive is shown in drawing 7. In the usual liquid crystal display, the back light (white light) was divided into three colors of RGB with the light filter, and writing the signal of each RGB in the pixel corresponding to each RGB has realized the full color display. On the other hand, in an FSC drive system, one pixel performs RGB 3 color specification. RGB3 color specification is performed by one pixel by dividing 1 frame period into the subframe of each RGB, and turning on the

light source which has a spectrum spectrum of each RGB synchronizing with it. Since driver ICs are reducible when a light filter becomes unnecessary and a pixel number drops to 1/3 by this, there is a merit that cost is reducible. The displays which are more suitable for an animation by writing in a non image signal, such as black insertion and white insertion, are realizable.

[0029]To use an FSC drive, since it is necessary to write the signal of each RGB in 1 frame period, compared with the usual liquid crystal display, it is necessary to it to carry out the high-speed writing of 3 times or more. Then, it becomes important what the current of a thin film transistor is enlarged, and this invention demonstrates an effect. A pixel only drops [the liquid crystal display of an FSC drive] to 1/3 as array constitution, and there are not the usual liquid crystal display and an essential difference. Therefore, a current amount can be enlarged like Example 1 by drawing 1 and using the structure and arrangement like drawing 5 from drawing 3, and high-speed writing is attained. That is, an FSC drive is attained.

[0030]In an FSC drive, when displaying the animation, a liquid crystal material and Mohd with quicker speed of response are suitable, and an OCB mode etc. are used. In this case, since liquid crystal capacity becomes large, larger driving ability is needed and the effect of this invention becomes large.

[0031](Embodiment 3) Drawing 6 is a figure in the liquid crystal display of Embodiment 3 showing pixel structure.

[0032]In this invention, polar write-in capability with severer charge is raised by electrically connecting an electrode with larger effective channel width to a picture element electrode. At this time, as mentioned above, Cgd becomes large and a recharge becomes large. As already stated, the influence which Cgd increases is small, but also when it cannot ignore depending on spec., such as size and resolution, it produces. For example, it is a case so that panel size may be large and it may be high-resolution. If panel size becomes large, the provincial accent of a gating signal waveform will become large, and the amount of recharges in case a gating signal turns off becomes large, and produces a flicker. Since the provincial accent of a gating waveform becomes large as it keeps away from the input side of a gating signal, the amount of recharges also becomes large in connection with it. A flicker arises by the difference in this amount of recharges. In such a case, with the structure and arrangement of this invention, by adopting the tilted structure of Cgd, the amount of recharges can be made uniform and a flicker can be prevented. Drawing 6 is the example which adopted the Cgd inclination. The amount of recharges can be made uniform by enlarging the field where a drain electrode laps with a gate electrode as it keeps away from the input side of a gating signal as shown in a figure (as it goes to right-hand side by drawing 6 from left-hand side). In this example, it has realized by changing a part of field (WX1 of a figure, field shown by WXiWXn) with which the drain electrode and the gate electrode have lapped. Of course, other portions may be changed as long as it is the field with which the drain electrode and the gate electrode have lapped. a gating signal -- right and left -- either -- when [which keeps away from the signal input side] having inputted from one side, and what is necessary is for it to be alike, and to follow and just to enlarge Cgd and the signal input is being carried out from both sides, it goes in the center from both the right and left ends -- what is necessary is for it to be alike, and to follow and just to enlarge Cgd

[0033](Embodiment 4) Drawing 8 is a circuit diagram showing the circuitry of the organic electroluminescence display of Embodiment 4. Circuitry is an example. Circuit operation is as follows.

[0034]An organic electroluminescence display X direction-signals lines 70a and 70b, ..., Y direction-

signals line 80a, 80b, ..., the power source wires 90a and 90b, ..., the thin film transistor 100a for a switch, It is constituted by 100b, ..., the thin film transistors 110a and 110b for current control, ..., the organic EL devices 120a and 120b, ..., capacitor 130a.130b, ..., the direction circumference drive circuit 140 of X, and direction circumference drive circuit of Y 150 grade.

[0035]The one [a pixel is specified by X direction-signals line 70 and Y direction-signals line 80, and / the thin film transistor 100 for a switch] in the pixel. Thereby, are one [the thin film transistor 110 for current control], and by the current supplied from the power source wire 90, current flows into the organic EL device 120, and an organic EL device emits light.

[0036]For example, if the signal according to image data is outputted to X direction-signals line 70a and the direction scanning signal of Y is outputted to Y direction-signals line 80a, The thin film transistor 100a for a switch of the pixel specified by this is turned on, the thin film transistor 110a for current control will flow with the signal according to image data, the current according to this picture will flow into the organic EL device 120a, and an organic EL device will emit light. Thus, a picture signal is written in all the pixels, and a picture is displayed. In the circuit which especially an important thing is the thin film transistor 110 which sends a picture signal to an organic EL device directly in this invention, and is shown in drawing 9, When a thin film transistor is an n channel type, an electrode with larger effective channel width is connected to the organic EL device side among a source electrode and a drain electrode, and when a thin film transistor is an n channel type, an electrode with smaller effective channel width is electrically connected to the organic EL device side. Since the sauce of a thin film transistor and the polarity relationship of a drain are set up by this so that current may become large more, and large current flows into an organic EL device by it, rewriting of display information becomes high-speed and it comes to be able to perform a more exact display. Since the current amount per unit area can be enlarged, shape of a thin film transistor can be made small, and the area of the possession-in-portions machine EL element can also be increased (improvement in a numerical aperture).

[0037]This example can show an example of an organic electroluminescence display, and can take various circuitry in an organic electroluminescence display. In arrangement of the thin film transistor in which the point of this invention has the asymmetric structure directly electrically connected with an organic EL device, In the case of an n channel thin film transistor, among the source electrode of a thin film transistor, and a drain electrode, What is necessary is just to constitute a circuit in the case of a p channel thin film transistor so that an electrode with smaller effective channel width may become negative polarity so that an electrode with larger effective channel width may become negative polarity. This reason is because driving ability of a thin film transistor can be enlarged by being the same as the explanation of the liquid crystal element in Embodiment 1, and making the source electrode and drain electrode of a thin film transistor into the above polarity relationship. It differs from the case of a liquid crystal element that the sauce of the thin film transistor for a pixel drive and the polarity relationship of a drain are eternal during drive operation. The thin film transistor with asymmetric structure can take various structures, as shown in drawing 5 from drawing 1 and drawing 3. Even if even bending structure comprises two or more electrodes, it does not interfere. The combination may be sufficient. The current amount per unit area can be made into the optimal structure to enlarge by increasing an electrode with the larger effective channel width among a source electrode and a drain electrode 2.5 times from 1.2 times of the width of an electrode with smaller effective channel width.

[0038]Since the asymmetry of the current potential characteristic of the asymmetric structure thin film transistor which is the main point of this invention depends on parasitic resistance and career

distribution, semiconductor membrane of an effect is [an amorphous silicon or polycrystalline silicon] the same [a top gate type or a bottom product gated mode]. When performing low speed driving comparatively, what is necessary is just to make the thin film transistor using the amorphous silicon film which can be formed with a small routing counter as semiconductor membrane arrangement like this invention, and. When performing high speed drives, such as an FSC drive, or when large current is required in order to make light emit [display / organic electroluminescence], semiconductor membrane with large mobility like polycrystalline silicon may be used.

[Translation done.]